

TARGETED NANOPARTICLES

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 16/200,095, filed Nov. 26, 2018 which is a continuation of U.S. patent application Ser. No. 15/291,485 now U.S. Pat. No. 10,166,291 issued Jan. 1, 2019 which is a continuation of U.S. patent application Ser. No. 13/782,458 filed Mar. 1, 2013 now U.S. Pat. No. 9,468,681 issued Oct. 18, 2016 the contents of each of which are incorporated by reference herein in its entirety for all purposes.

GOVERNMENT RIGHTS

[0002] This invention was made with government support under Grant No. CA 151819 and under Grant No. CA 119347 awarded by the National Institutes of Health. The government has certain rights in the invention.

SEQUENCE LISTING

[0003] The instant application contains a Sequence Listing which has been submitted in ASCII format via EFS-Web and is hereby incorporated by reference in its entirety. Said ASCII copy, created on Nov. 20, 2018, is named 122009_000548_SequenceListing.txt and is 1,549 bytes in size.

TECHNICAL FIELD

[0004] The present disclosure relates to carrier nanoparticles and in particular to nanoparticles suitable for delivering compounds of interest, and related compositions, methods and systems.

BACKGROUND

[0005] Effective delivery of compounds of interest to cells, tissues, organs, and organisms has been a challenge in biomedicine, imaging and other fields where delivery of molecules of various sizes and dimensions to a predetermined target is desirable.

[0006] Whether for pathological examination, therapeutic treatment or for fundamental biology studies, several methods are known and used for delivering various classes of biomaterials and biomolecules which are typically associated with a biological and/or chemical activity of interest.

[0007] As the number of molecules suitable to be used as chemical or biological agents (e.g. drugs, biologics, therapeutic or imaging agents) increases, development of a delivery systems suitable to be used with compounds of various complexity, dimensions and chemical nature has proven to be particularly challenging.

[0008] Nanoparticles are structures useful as carriers for delivering agents with various methods of delivery. Several nanoparticle delivery systems exist, which utilize an array of different strategies to package, transport, and deliver an agent to specific targets.

SUMMARY

[0009] Provided herein are nanoparticles and related compositions, methods and systems that in several embodiments provide a multifunctional tool for effective and specific delivery of a compound of interest. In particular, in several embodiments, nanoparticles herein described can be used as

a flexible system for carrying and delivering a wide range of molecules of various sizes, dimensions and chemical nature to predetermined targets.

[0010] According to one aspect, a nanoparticle comprising a polymer containing a polyol and to a polymer containing a boronic acid is described. In the nanoparticle, the polymer containing a boronic acid is coupled to the polymer containing a polyol and the nanoparticle is configured to present the polymer containing a boronic acid to an environment external to the nanoparticle. One or more compounds of interest can be carried by the nanoparticle, as a part of or attached to the polymer containing a polyol and/or the polymer containing a boronic acid.

[0011] According to another aspect, a composition is described. The composition comprises a nanoparticle herein described and a suitable vehicle and/or excipient.

[0012] According to another aspect, a method to deliver a compound to a target is described. The method comprises contacting the target with a nanoparticle herein described wherein the compound is comprised in the polymer containing a polyol or in the polymer containing a boronic acid of the nanoparticle herein described.

[0013] According to another aspect, a system to deliver a compound to a target is described. The system comprises at least a polymer containing a polyol and polymer containing a boronic acid capable of reciprocal binding through a reversible covalent linkage, to be assembled in a nanoparticle herein described comprising the compound.

[0014] According to another aspect, a method to administer a compound to an individual is described. The method comprises administering to the individual an effective amount of a nanoparticle herein described, wherein the compound is comprised in the polymer containing a polyol and/or in the polymer containing a boronic acid.

[0015] According to another aspect, a system for administering a compound to an individual is described. The system comprises, at least a polymer containing a polyol and polymer containing a boronic acid capable of reciprocal binding through a reversible covalent linkage, to be assembled in a nanoparticle herein described attaching the compound to be administered to the individual according to methods herein described.

[0016] According to another aspect, a method to prepare a nanoparticle comprising a polymer containing a polyol and a polymer containing a boronic acid is described. The method comprises contacting the polymer containing polyols with the polymer containing a boronic acid for a time and under condition to allow coupling of the polymer containing polyol with the polymer containing a boronic acid.

[0017] According to another aspect, several polymer containing a boronic acid are described which are illustrated in details in the following sections of the present disclosure.

[0018] According to another aspect, several polymers containing polyols are described, which are illustrated in details in the following sections of the present disclosure.

[0019] Also described herein are nanoparticles having a polymer containing a polyol that are conjugated to polymers having a nitrophenylboronic acid group, which enhances the stability of the nanoparticle by reducing its pKa.

[0020] Another aspect of the present disclosure provides a description of targeted nanoparticles that, in some embodiments, can have only one single targeting ligand, which is capable of promoting delivery of the nanoparticle to a particular target, such as a cell expressing a binding partner